

THREE- AND TEN-YEAR GOALS AND OBJECTIVES RELATIVE TO FUNDING COAL RESEARCH, DEVELOPMENT AND DEMONSTRATION PROJECTS

JUNE 10, 2013

The Three- and Ten-Year Goals and Objectives contained herein are being submitted in accordance with the provisions of Public Act 88-391, Sec. 4 (b), which states:

"The department shall develop a written plan containing measurable 3- and 10-year goals and objectives in regard to the funding of coal research, demonstration and commercialization projects. In developing these goals and objectives, the department shall consider and determine the appropriate balance for the achievement of near- and long-term goals and objectives of ensuring the timely commercial application of cost-effective technologies or energy and chemical production processes or systems using coal. The department shall develop the initial goals and objectives no later than December 1, 1993, and develop revised goals and objectives no later than July 1 annually thereafter."

Listed on the following pages are the FY2014 revisions to the Coal Research Funding Priorities. The Research and Development (R&D) program is being conducted by the Illinois Clean Coal Institute (ICCI) based in Carterville, Illinois. The Development program is administered through the Office of Coal Development (OCD) in Springfield. The primary objectives and the goals by research area, are in accordance with those approved earlier by OCD through the ICCI's annual Request for Proposals (RFP) document.

PRIMARY OBJECTIVES

The Primary objectives are to administer comprehensive statewide coal research, development and demonstration programs that will:

- Maintain and maximize national and international markets for the clean use of Illinois coal;
- Maximize the value of Illinois coal through the development of new markets and new products, processes or uses for clean coal;
- Maximize the competitiveness of Illinois coal by improved mining technologies and business practices;
- Work with the federal government, private industry, utilities and research organizations to attract installation of new/updated technologies that will use Illinois coal as a feedstock;
- Maximize the economic and environmental use or disposal of coal wastes and coal combustion by-products;
- Leverage funds and other resources available for research, development and demonstration of clean-coal technologies (CCTs); and
- Increase the awareness of Illinois coal resources and their economic and environmental use in Illinois and other markets.

FUNDING PRIORITIES BY RESEARCH AREA

(Subject to receipt of suitable proposals.)

3- AND 10-YEAR GOALS FOR CARBON MANAGEMENT

This program area targets the two best-known greenhouse gases – carbon dioxide (CO₂) and methane (CH₄). It includes investigating improved methods of CO₂ capture from coal combustion, development of new or improved methods of CO₂ removal from syngas, investigating efficient methods for CO₂ sequestration, and developing economically feasible methods for production of coal bed methane (CBM) from Illinois coal seams.

3-Year Goals

- Support R&D of methods for the sequestration of CO₂ that expand, compliment and/or contribute to the existing program of the Midwest Geological Sequestration Consortium in the State of Illinois.
- Research on economically feasible CBM production technologies for the Illinois Basin.

10-Year Goals

- Support and development of the U.S. DOE FutureGen Project, or a similar project with gasification of Illinois coal and CO₂ sequestration.
 - Commercial production of methane from coal seams in Illinois.
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3- AND 10-YEAR GOALS FOR COAL MINING TECHNOLOGY

This program area emphasizes developing technologies and methods that will reduce the cost of mining Illinois coal. It includes programs for developing improved mining technologies as well as programs for training miners in safety and increased productivity.

3-Year Goals

- Develop improved mining methods and technologies to improve productivity.
- Develop mining systems that increase miner safety and reduce costs through improved efficiencies.
- Promote the best available coal mining practices through technology transfer publications and workshops.
- Assist the Illinois coal mining industry with development of training programs to increase the skill level, safety awareness, and cost consciousness of mine personnel and to raise performance standards throughout the industry.

10-Year Goals

- Implementation of improved mining equipment, methods and technologies at Illinois coal mines that would reduce mining costs and keep Illinois coal competitive with other fuels.

- Improve skill levels of Illinois coal miners and resources available to them resulting in increased safety, efficiency and productivity.
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3- AND 10-YEAR GOALS FOR COAL PREPARATION

This program area focuses on business practices that prepare raw coal for market and handle associated waste products in an environmentally sound and acceptable manner. It includes coal cleaning by both physical and chemical methods to remove and dispose of extraneous mineral matter in the coal.

3-Year Goals

- Develop and demonstrate innovative, cost-efficient technologies for fine coal recovery, cleaning and dewatering.
- Optimize total plant systems in terms of processing costs, coal recovery and coal quality.
- Develop and implement technologies and methodologies that improve environmental compliance while minimizing total production costs including the cost of waste disposal.

10-Year Goals

- Implement new technologies for coal cleaning and dewatering to improve Illinois coal quality and lower costs.
 - Lower the cost of using Illinois coal by improving business practices.
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3- AND 10-YEAR GOALS FOR COAL GASIFICATION

This program area targets the preferred coal utilization system for Illinois coal. It includes carbon management in coal gasification, analysis of permitting issues for coal gasification plants located in Illinois, study of water usage in coal gasification, investigation of synergies in the production of biofuels such as ethanol and biodiesel and coal gasification, and the effects of coal properties on downstream systems of coal gasification installations. This area also covers improved methods for the removal of impurities from coal gasification syngas.

3-Year Goals

- Support R&D towards economic methods for gasifying Illinois coal to produce hydrogen, utility fuel gases and/or a syngas for manufacturing intermediate products.
- Develop economic processes for syngas cleanup, especially at higher temperatures.
- Develop catalysts for the successful conversion of syngas to transportation fuels.

10-Year Goal

- Contribute to all efforts to attract a commercial gasification facility to Illinois.

3- AND 10-YEAR GOALS FOR POWER GENERATION AND PLANT EFFICIENCIES

This area focuses on evaluation of advanced concepts to increase the efficiency of existing coal boilers while meeting emission requirements, materials research for advanced boilers and wet scrubber systems, and the investigation of alternative coal-based fuels for natural gas combined-cycle plants and novel industrial combustors using Illinois coal

3-Year Goals

- Development of improved methods of combusting Illinois coal to improve efficiency and thus reduce CO₂ emissions.
- Reduce the cost of meeting current and future air emission requirements.
- Investigate novel industrial uses of Illinois coal.
- Support oxycombustion as a repowering technology.

10-Year Goals

- Repowering of existing utilities with new technologies so that they can meet existing and future emission requirements while burning Illinois coal.
- Identify several promising advanced concepts for coal combustion such as oxygen injection with recycled flue gas to reduce the volume of combustion gases and lower capital costs for FGD units.

3- AND 10-YEAR GOALS FOR FLUE GAS CLEANING AND TRACE ELEMENT REMOVAL

The areas of interest in this section include optimization of SCR and flue gas scrubbers to maximize multipollutant control, methods to enhance SO₂ capture in scrubbers while at the same time enhancing mercury removal, modification of the FGD chemistry to promote mercury capture, effective removal of chlorides from FGD scrubbing liquid, development of new catalyst formulations capable of oxidizing mercury that could be housed in the selective catalytic reduction (SCR) reactors at power plants, and investigation of Illinois limestone reactivity for application in scrubbers and FBC units.

3-Year Goals

- Develop improved and/or modified wet and dry scrubbers or other systems to economically provide coordinated multipollutant control of SO_x, NO_x, mercury, PM_{2.5} and other related hazardous air pollutants (HAP) in combustion flue gases where high-sulfur Illinois coal is used.
- Increase the depth of understanding of the chemistry of trace metal speciation and capture in wet flue gas scrubbers.

10-Year Goals

- Develop and implement novel or improved flue gas desulfurization methods to assure continuation of Illinois coal markets and to help electric utilities using Illinois coal to meet Clean Air Act limits for SO_x, NO_x, PM, and mercury.
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3- AND 10-YEAR GOALS FOR COAL CHEMISTRY

Coal Chemistry includes investigations into the structure of coal, fundamental reactions for improved and/or novel coal liquefaction, and basic reactions for purification and/or upgrading of Illinois coal. This area also covers the production of chemical intermediates and fuels from coal gasification syngas.

3-Year Goals

- Increase our fundamental knowledge of coal structure, the chemical reactions for the production of fuels and chemical intermediates from syngas, and purification or upgrading of Illinois coal.
- Develop R&D for the production of high-value products from coal via a non-gasification (i.e., direct) route. Of interest are any high value chemicals, including coal tar pitches.
- Production of coal-derived chemicals and fuels from coal syngas or other processes.
- Support research and development of the OHD process.
- Investigations into the structure of coal, and how the structure can be manipulated or altered to remove high levels of impurities, such as ash, organic sulfur, and chlorine. Economic processes for the removal of mineral matter (not via conventional coal preparation techniques), sulfur, and trace elements are of interest.

10-Year Goals

- Use the fundamental knowledge of coal chemistry to improve technologies for alternative coal utilization processes.
 - Contribute to all efforts to attract an alternative coal utilization process facility to Illinois.
 - Investigations into the structure of coal, and how the structure can be manipulated or altered to remove high levels of impurities, such as ash, organic sulfur, and chlorine.
 - Develop economic processes for the removal of mineral matter and sulfur via non-conventional techniques).
 - Contribute to all efforts to attract a commercial OHD facility to Illinois.
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3- AND 10-YEAR GOALS FOR COAL DEVELOPMENT

Development projects are directed towards technology and concept development that can be implemented in the shorter term to assist Illinois utilities and coal companies in complying with Clean Air Act regulations and, in the longer term, to maximize the use of Illinois coal as the fuel of choice for new power plants.

3-Year Goals

- Evaluate the use of Illinois coal in advanced power generation systems such as PCFBC or IGCC.
- Identify research projects supported by the ICCI and others that have technical and economic potential for further development.
- Develop R&D for the production of high-value products from coal via a non-gasification (i.e., direct) route. Of interest are any high value chemicals, including coal tar pitches. Support research and development of the OHD process.
- Identify and screen promising emission control technologies with the potential to be significantly cheaper than commercially available systems.
- Test and compare the effectiveness of using oxygen-enriched flue gas for combustion of Illinois coal to reduce the size and capital costs of multi-pollutant control.
- Assist in the demonstration of innovative scrubber technologies by supporting data collection and analysis tasks for anticipated industrial demonstrations.
- Assist in the demonstration of advanced mining and preparation technologies that will lead to commercialization.

10-Year Goals

- Implement technologies that will lower carbon dioxide emissions by improved efficiencies in coal combustion and/or improve the methods of sequestration.
- Select and develop the most promising advanced emission control technologies to a stage where utility demonstration is justified.
- Provide a list of technologies that can be used by appropriate industry groups to identify potential commercial opportunities.
- Bring at least one technology for the production of high-value products from coal via a non-gasification (i.e., direct) route to the commercial stage.
- Contribute to all efforts to attract a commercial OHD facility to Illinois.